DOI: 10.1111/1745-9133.12485

CRIMINOLOGY & Public Policy

SPECIAL ISSUE ARTICLE

COUNTERING MASS VIOLENCE IN THE UNITED STATES

Assessing the potential to reduce deaths and injuries from mass shootings through restrictions on assault weapons and other high-capacity semiautomatic firearms

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The author thanks William Johnson for research assistance in the preparation of this paper. An earlier version of this paper was presented at the George Mason University-Carnegie Mellon University Workshop on An Evidence-Based Approach to Understanding and Countering Mass Violence in America held in April 2019 with funding from the National Science Foundation. The author thanks conference participants for their comments on the earlier draft.

Research Summary: This article examines the use, impacts, and regulation of assault weapons and other high-capacity semiautomatic firearms as they pertain to the problem of mass shootings in the United States. High-capacity semiautomatics (which include assault weapons as a subset) are used in between 20% and 58% of all firearm mass murders, and they are used in a particularly high share of public mass shootings. Mass shootings perpetrated with these firearms result in substantially more fatalities and injuries than do attacks with other firearms, and these differences are especially pronounced for the number of victims with nonfatal gunshot injuries. The federal ban on assault weapons and large-capacity (>10 rounds) ammunition magazines of 1994 had exemptions and loopholes that limited its short-term effects, but its expiration in 2004 was followed by an increase in the use of these weapons in mass shootings and other crimes. Growing evidence suggests that state-level restrictions on large-capacity magazines reduce mass shootings, but further research is needed on the implementation and effects of these laws.

Policy Implications: Restrictions on large-capacity magazines are the most important provisions of assault weapons laws in part because they can produce broader reductions in the overall use of high-capacity semiautomatics that facilitate high-volume gunfire attacks. Data on mass shooting incidents suggest these magazine restrictions can

potentially reduce mass shooting deaths by 11% to 15% and total victims shot in these incidents by one quarter, likely as upper bounds. It may take several years for the effects of these laws to be fully realized, however, depending on their specific provisions, especially with regard to treatment of pre-ban weaponry.

Dating back to the 1980s, public concern over mass shootings in the United States has prompted ongoing debates about the need to restrict particularly deadly categories of firearms that can facilitate the commission of such acts. These debates have focused broadly on semiautomatic firearms with large ammunition capacities and more specifically on subsets of these firearms, known as "assault weapons," with additional military-style features that are believed to make them more dangerous and/or attractive for criminal uses. Over the last several decades, these types of firearms have been used in many of the most deadly and injurious acts of mass violence in the United States. In response, the federal government imposed restrictions on these weapons in 1994 but allowed them to expire in 2004. Debates about reinstating these restrictions have intensified during the last few years mainly in response to several recent and highly tragic public mass shootings perpetrated with assault weapons or other high-capacity semiautomatics. Although efforts to revive the federal restrictions have been unsuccessful to date, nine states and the District of Columbia currently have their own restrictions on such weapons, as do some additional localities (see the Giffords Law Center to Prevent Gun Violence at https://lawcenter.giffords.org/).

In this essay, I examine available data on the use of assault weapons and other high-capacity semiautomatics in mass shootings and investigate the potential to reduce deaths and injuries from mass violence through restrictions on these weapons. I also examine whether federal and state restrictions on these weapons have been effective in reducing their use in mass shootings. In summary, available evidence, while limited in quantity and precision, suggests that restrictions on these weapons have the potential to reduce deaths and injuries from mass shootings, at least modestly and perhaps by more substantial margins, especially for nonfatal injuries. Despite the limitations of the prior federal law restricting these weapons, its expiration has coincided with a rise in crimes with high-capacity semiautomatics that has likely contributed to higher victim counts in mass shootings. The effects of state-level restrictions, which vary in important ways, are not yet clear, even though there is growing evidence that states with these restrictions have fewer mass shootings. Having noted these tentative conclusions, there is need for better data and more in-depth research on various aspects of this issue.

1 | OVERVIEW ON THE AVAILABILITY, USE, AND RESTRICTION OF ASSAULT WEAPONS AND OTHER HIGH-CAPACITY SEMIAUTOMATICS

Laws aimed at curbing the availability and use of semiautomatic assault weapons (AWs) and other high-capacity semiautomatics focus on two categories of weaponry.[1] AW laws impose restrictions on semiautomatic firearms that accept detachable ammunition magazines and have one or more additional military-style features that are considered useful in military and criminal applications but unnecessary in shooting sports or self-defense. Examples of the latter features include pistol grips on rifles, flash hiders, folding rifle stocks, threaded barrels for attaching silencers, and barrel shrouds on pistols.[2]

AW laws are typically complemented by restrictions on large-capacity magazines (LCMs), which are most commonly defined as ammunition feeding devices holding more than 10 rounds of ammunition. Some LCM laws allow or have previously allowed higher limits for some or all firearms, and a few states have LCM restrictions without bans on AWs (all states with AW bans currently have LCM bans, but that has not always been true). Other salient features of these laws are discussed in subsequent sections.

LCM restrictions are arguably the most important components of AW–LCM laws—and thus the most relevant to the amelioration of mass shootings—for two reasons. One is that an LCM is the most functionally important feature of an AW-type firearm. Guns defined as AWs can often be equipped with LCMs holding 30 or more rounds; hence, removing LCMs from these weapons greatly limits their firepower. In other respects, AW-type firearms do not operate differently than other comparable semiautomatics, nor do they fire more lethal ammunition. The second reason is that LCM restrictions also apply to the much larger class of high-capacity semiautomatics without military-style features. This includes many common semiautomatic pistol and rifle models that are sold with LCMs in the range of 11–20 rounds or sometimes higher. LCM restrictions do not ban all firearms capable of accepting LCMs, but they do limit the capacity of the ammunition magazines that can be sold for these weapons. LCM restrictions thus have the ability to affect a much larger share of gun crimes. Accordingly, the discussion below places a greater emphasis on the overall use and restriction of firearms with LCMs. (The terms "LCM firearm" and "high-capacity semiautomatic" are used interchangeably throughout this essay to refer to any semiautomatic with an LCM, including both AW and non-AW models.)

In the broadest sense, AW–LCM laws are intended to reduce gunshot victimizations by limiting the stock of semiautomatic firearms with large ammunition capacities and, to a lesser degree, other features conducive to criminal use. Although offenders blocked from access to AWs and LCMs can commit crimes with other guns and smaller magazines, the logic underlying AW–LCM laws is that forcing this substitution should limit the number of shots fired in gun attacks, thus, reducing the number of people shot per attack and/or the number sustaining multiple wounds. This idea is supported by a small number of studies suggesting that attacks with semiautomatic firearms—including AWs and other guns equipped with LCMs—tend to result in more shots fired, more persons wounded, and more wounds inflicted per victim than do attacks with other firearms (Jager et al., 2018; Koper, 2004; McGonigal et al., 1993; Reedy & Koper, 2003; Richmond, Branas, Cheney, & Schwab, 2004; Roth & Koper, 1997). With respect to mass shootings in particular, AW and LCM use could conceivably affect both the prevalence and the severity of mass shootings by increasing the likelihood that shooting incidents produce enough victims to qualify as a mass shooting (Jager et al., 2018) and increasing the number of fatalities and injuries per mass shooting. Evidence on these matters is considered in more detail below.

Semiautomatic weapons with LCMs and other military-style features are common among models produced in the contemporary gun market (e.g., Lee, 2014; Violence Policy Center, 2011), but precise estimates of their production and ownership are unavailable.[3] National survey estimates indicate that 18% of all civilian-owned firearms and 21% of civilian-owned handguns were equipped with magazines having 10 or more rounds in 1994 (Cook & Ludwig, 1996, p. 17) just before the passage of the federal AW–LCM ban, which prohibited further production of LCMs but allowed continued ownership and sale of pre-ban LCMs. More recent estimates are not available, but these numbers have likely grown since the federal ban expired in September 2004.

Recent studies of criminal use of AWs and other LCM firearms indicate that AWs (primarily assault-type rifles) account for 2% to 12% of guns used in crime in general (based on analysis of guns recovered by police), with most estimates suggesting they account for less than 7%. In combination, however, AWs and other high-capacity semiautomatics account for 22% to 36% of crime guns overall,

and some estimates suggest they account for higher shares (upward of 40%) of guns used in serious violence (Koper, Johnson, Nichols, Ayers, & Mullins, 2018).[4] Notably, high-capacity semiautomatics have grown by as much as 112% as a share of crime guns since the expiration of the federal ban. This trend has coincided with recent growth in shootings nationwide (Fowler, Dahlberg, Haileyesus, & Annest, 2015; Koper et al., 2018) and may also be linked to a rising incidence of high-volume gunfire incidents (Koper, Johnson, Stesin, & Egge, 2019). Mass shootings in public locations have also grown in incidence and severity (i.e., victim counts) during this time (Duwe, 2020, this issue; Lankford & Silver, 2020, this issue), and many of these recent tragedies have been perpetrated by offenders using AWs or other high-capacity semiautomatics. The Citizens Crime Commission of New York City (CCCNYC), for instance, reported that there were 19 public mass shootings between 2005 and February 2018 in which offenders with LCM firearms killed at least four people and in total killed or wounded at least 10 (Cannon, 2018). These developments suggest the need for a closer examination of the degree to which AW and LCM use contribute to deaths and injuries from mass violence.

2 | USE AND IMPACTS OF HIGH-CAPACITY SEMIAUTOMATICS IN MASS SHOOTINGS

Measuring the use of AWs and other LCM firearms in mass shooting incidents presents several challenges. For one, there is no universal definition of a mass shooting incident. Across different data sources and studies, researchers have defined these incidents using different numeric thresholds based on fatalities and/or total victim counts. The discussion below focuses on studies of firearm mass murders defined as incidents in which at least four persons were killed, not including the shooter if applicable and irrespective of the number of additional victims shot but not killed.[5] This is consistent with many prior studies of mass shootings. Inferences about the use of AWs and other LCM firearms in mass shootings, however, could differ based on other fatality thresholds or definitions of mass shootings that are based on wounded victims.

A further complication is that there is no official data source that regularly provides detailed and comprehensive data on the types of guns and magazines used in shooting incidents or that provides full counts of victims killed and wounded in these attacks.[6] Accordingly, detailed information on mass shootings and the weapons involved must be gathered mainly from media searches, open sources, and public databases that have been compiled by various media, public interest, research, and government organizations. Analyses based on these sources are thus contingent on their comprehensiveness and accuracy. Some sources attempt to capture all mass shootings (however defined), whereas others focus specifically on public mass shootings that are unrelated to other forms of crime (like robbery, gang, or drug violence). This particular type of mass shooting has become an increasing societal concern as result of the seemingly random nature of many of these incidents, their substantially higher and growing victim counts (Duwe, 2020; Krouse & Richardson, 2015; Lankford & Silver, 2020),[7] and the higher use of AWs and other high-capacity semiautomatics in these incidents (on the latter point, see below; also see Duwe, 2007; Koper et al., 2018; Krouse & Richardson, 2015).

Finally, there are notable difficulties surrounding the identification of AWs and other LCM firearms in these public sources. Information on weapons and magazines used is often missing or insufficiently detailed to make a definitive determination as to whether the firearm(s) used was an AW or an LCM firearm;[8] hence, reported counts of these weapons are often minimum estimates of their use. The identification of AWs may also vary somewhat across sources as there is no universal definition of an AW that applies across all current and past federal and state AW laws.[9] Sources vary, moreover, in the extent to which they document these issues when AW and LCM firearm counts are reported.

TABLE 1 Selected estimates of assault weapon and large-capacity magazine use in firearm mass murders

Data Source and Sample	% With Any LCM Firearm	% With AW Model
Everytown for Gun Safety (2018): all firearm mass murders with 4+ killed, 2009–2017 ($N = 173$)	20% (min) – 58% (max)	Not estimated
Koper et al. (2018): all firearm mass murders with 4+ killed, 2009–2015 ($N = 145$)	19% (min) – 57% (max)	10% (min) – 36% (max)
Krouse and Richardson (2015): all firearm mass murders with 4+ killed, 1999–2013 ($N = 317$)	Not estimated	10% (all incidents) 27% (public incidents)
Klarevas (2016): all firearm mass murders with 6+ killed, 1966—2015 ($N = 111$)	47% (all years) 67% (2006–2015)	25% (all years) 26% (2006–2015)
Mother Jones (Follman, Aronsen, & Pan, 2019): public firearm mass murders with 4+ killed that did not involve other crimes, 1982–Jan. 2019 ($N = 92$)	45% – 61%, or higher	Not estimated

Notes. The maximum estimates from Everytown (2018) and Koper et al. (2018) are based on calculating LCM or AW cases as a percentage of only those cases in which a definitive determination could be made about the weapon type. The Koper et al. LCM counts include cases involving gun models typically sold with an LCM, even if the magazine recovered was not explicitly reported. The estimates from *Mother Jones* (Follman et al., 2019) are original tabulations using data available as of this writing and exclude cases with fewer than four fatalities. The *Mother Jones* range is based on cases with explicit reporting of an LCM (45%) combined with cases that clearly involved gun models typically sold with an LCM (totaling 61%). The estimate would be higher if adjusted for missing gun model data.

2.1 | Estimates of the use of high-capacity semiautomatics in mass shootings

Having stated these caveats, I present several estimates of the use of AWs and other LCM firearms in mass murder shooting incidents in Table 1. This collection does not include all AW and LCM estimates that researchers have reported but focuses, rather, on recent estimates (post-2000) and specialized sets of cases that seem particularly pertinent to the AW–LCM debate. In some instances, the table highlights multiple figures of interest reported by researchers. Additional details about the estimates are provided in the table notes.

These studies suggest that LCM firearms are used in at least 20% of all firearm mass murders; adjusting for missing gun data in available sources, this figure could be upward of 50% (Everytown for Gun Safety, 2018; Koper et al., 2018). Specific AW models are used in at least 10% of all firearm mass murders and potentially as many as a third, adjusting for missing data (Koper et al., 2018; Krouse & Richardson, 2015). The use of AWs and other high-capacity semiautomatics is higher in public mass shootings (Follman et al., 2019; Krouse & Richardson, 2015) and in cases that involve higher fatality counts (Klarevas, 2016).[10] Most notably, estimates suggest that LCM firearms are involved in approximately half to two thirds of public mass shootings and firearm mass murders involving six or more fatalities. Furthermore, some data suggest that the use of high-capacity semiautomatics in mass murders has been rising over time (Klarevas, 2016).

Overall, these figures suggest that high-capacity semiautomatics are used disproportionately in mass shootings relative to their use in gun crime more generally (see prior discussion of Koper et al., 2018). This pattern likely reflects a combination of the greater firepower of these weapons and the

characteristics and intentions of shooters who use them in these rampages. These estimates also serve as rough upper bound estimates of the extent to which LCM restrictions might reduce the occurrence of firearm mass murders. Most conservatively, they imply that eliminating LCM use might reduce the overall incidence of firearm mass murders up to 19% to 20% based on minimum estimates of their use in these cases and contingent on the four-fatality threshold.[11] The actual effect might well be considerably smaller, however, because offenders could likely kill four or more victims in many of these cases even if using non-LCM firearms.

Developing a better understanding of the extent to which LCM firearm use affects the incidence of firearm mass murders would require studies comparing representative samples of attacks with LCM and non-LCM firearms to determine how LCM use affects the likelihood of a shooting incident resulting in a mass casualty event. One step in this direction has been taken by Jager et al. (2018), who studied weapon types used and victim differentials in active shooter incidents documented by the FBI from 2000 to 2017. The FBI defines these incidents as cases in which an individual is killing or attempting to kill people in a confined or populated area, irrespective of the number of persons killed or wounded (see https://www.fbi.gov/about/partnerships/office-of-partner-engagement/active-shooter-resources). Adjusting via regression modeling for the use of multiple firearms (which arguably reflects on the shooter's intentionality) and the location and year of the shooting, Jager et al. (2018) found that incidents involving semiautomatic rifles (which accounted for 25% of the cases and serve as a rough approximation of the use of AW-type and other LCM rifles) resulted in 97% more fatalities and 81% more wounded victims.[12] On average, semiautomatic rifle cases involved 4.3 fatalities and 5.5 persons wounded in contrast to 2.5 fatalities and 3.0 persons wounded in other cases. Although more work is clearly needed on this issue, these findings support the hypothesis that use of high-capacity semiautomatics has some impact on the incidence of mass murders.

2.2 | Impacts of high-capacity semiautomatics on mass shooting outcomes

Several studies have contrasted counts of victims killed and wounded in mass shootings with and without high-capacity semiautomatics. Selected figures from these studies are reported in Table 2, with a focus on victim differentials associated with use of any LCM firearm as reported in recent studies or specialized studies of public shootings or incidents with especially high fatality counts.[13] Based on these victim differentials, I also offer some projections of gunshot victimizations that could potentially be prevented through restrictions on LCMs. Note that the figures used from the most recent studies exclude the October 2017 Las Vegas mass shooting that resulted in 58 deaths and 413 injuries. This outlier event, which involved LCM weapons, resulted in several times more victims shot and killed than have all other firearm mass murders (its exclusion makes the LCM victim differentials in Table 2 more conservative).

Data from these studies consistently indicate that use of LCM firearms contributes to more deaths and injuries in mass shooting attacks and that this impact is most pronounced for counts of persons wounded (as reflected in Table 2 for the total victim counts). Across the studies, average fatalities are 38% to 85% higher when LCMs are used (based on the Klarevas [2016] and Everytown [2018] studies, respectively), with most estimates in the range of 60% to 67% (all other cited sources). Total victims killed and wounded, in contrast, are two to three times higher when LCMs are used in all sources with information on wounded victims. This is consistent with the concern that LCM weapons enable rapid spray fire that, although perhaps less accurate, gives offenders the ability to wound higher numbers of victims, particularly in crowded public settings. Another pattern that be gleaned from Table 2 is that the LCM victim differentials are a result in large measure of public mass shootings, which tend to produce higher victim counts in general but especially when LCM weapons are used.[14]

TABLE 2 Selected reports of victim differentials by large-capacity magazine use and estimates of potential victim reductions from large-capacity magazine restrictions

Data Source and Sample	Avg. Fatalities	Avg. Victim Totals (Killed and Injured)	Estimated Reduction From LCM Restriction
Everytown for Gun Safety (2018): all firearm mass murders with 4+ killed, 2009–2017 ($N = 172$, excluding the Oct. 2017 Las Vegas incident)	LCM: 8.7 Non-LCM: 4.7	LCM: 16.1 Non-LCM: 6.0	14% (deaths) 26% (total deaths and injuries)
Koper et al. (2018): all firearm mass murders with 4+ killed, 2009–2015 ($N = 145$)	LCM: 7.5 Non-LCM: 4.6	LCM: 13.7 Non-LCM: 5.2	11% (deaths) 24% (total deaths and injuries
Klarevas (2016): all firearm mass murders with 6+ killed, 1966–2015 ($N = 111$)	LCM: 9.5 Non-LCM: 6.9	Not estimated	15% (deaths)
Citizens Crime Commission of New York City (Cannon, 2018): public firearm mass murders with 4+ killed that did not involve other crimes, Jun. 1984–Feb. 2018 ($N = 78$, excluding Oct. 2017 Las Vegas incident)	LCM: 9.7 Non-LCM: 5.8	LCM: 20.5 Non-LCM: 8.8	30% (deaths) 46% (total deaths and injuries)
Dillon (2013): public firearm mass murders with 4+ killed that did not involve other crimes as reported by *Mother Jones*, 1982–2012 ($N = 62$)	LCM: 10.19 Non-LCM: 6.35	LCM: 22.58 Non-LCM: 9.9	23% (deaths) 39% (total deaths and injuries)

Notes. Calculations conducted by the author from the listed sources. The Everytown (2018) and Cannon (2018) data exclude the outlier Oct. 2017 Las Vegas LCM case that resulted in 58 killed and 413 injuries. Non-LCM calculations for the Everytown data are based on the highest victim estimates for cases that did not clearly involve an LCM (i.e., cases that definitely did not involve LCMs and cases with unknown LCM status).

Extrapolating from these patterns, we can also make rough estimates of the degree to which deaths and injuries in mass shooting events might be reduced by restrictions on LCMs. These calculations use the victim averages for non-LCM cases to estimate the level of death and injury that would have resulted from the LCM cases had attackers been forced to substitute non-LCM firearms. These estimates can then be used to project the number and percentage of deaths and injuries that could have been prevented across the full sample of incidents. As shown in the final column of Table 2, the projections suggest that LCM restrictions could potentially reduce fatalities by 11% to 15% across all firearm mass murder incidents and reduce total injuries by 24% to 26%.[15] Effects would likely be greater for public mass shootings, with total deaths and injuries in these cases potentially declining by somewhere between

one third and one half. The specific magnitudes of the estimates for public mass shootings, however, should be viewed with particular caution, given some of the concerns surrounding the completeness of those data sources and variations thereof (e.g., see Duwe, 2007, 2020). Also note that the prevention estimates overall would be higher if the Las Vegas incident was included in the most recent data sources.[16]

These estimates should be viewed as approximations based on several considerations. For starters, they are based on comparisons of victim differentials in LCM and non-LCM attacks that produced enough casualties to qualify as mass shootings. These attacks were perpetrated by offenders with a clear intent to shoot a large number of people, and they may provide the best estimates of LCM impacts under such conditions. Nonetheless, estimated LCM impacts on attack outcomes might possibly be larger or smaller if based on more comprehensive samples that included attempted, actual, and near mass shootings (e.g., Jager et al., 2018). The potential of LCM restrictions to reduce mass shootings might also be underestimated here if the availability of high-capacity semiautomatics increases the likelihood that some people will attempt mass shootings.

On the other hand, the impacts of LCM restrictions might be lower than these projections even with very large reductions in LCM availability. This is in part because some shooters with LCM weapons, notably those who had a clear intent and plan to kill and wound especially high numbers of victims, would have likely inflicted higher than average casualty counts even if they had used non-LCM firearms, although perhaps not to the same degree. One obvious adaptation to LCM restrictions would be to carry multiple non-LCM guns and/or low-capacity magazines. We should not assume, however, that use of multiple guns or magazines would completely negate the impacts of LCM use. Use of multiple firearms and magazines, while common in firearm mass murders, is not universal; some firearm mass murders (as well as other attacks with the potential to become mass shootings) happen spontaneously or without much premeditation. In such incidents, the lethality of the firearms and magazines at hand may be particularly consequential to the outcome. Furthermore, using multiple non-LCM guns and magazines for a sustained attack requires a shooter to make gun and/or magazine changes that reduce the rate of fire relative to using firearms with LCMs (e.g., see Klarevas, 2016, pp. 211–212). This arguably gives people under attack additional seconds to escape, take cover, or possibly overtake and incapacitate the shooter.

Although evaluating these arguments fully will require more in-depth analyses of the dynamics of mass shooting incidents (and perhaps near mass shooting incidents as well), available data and analyses do not provide obvious support for the multiple gun/multiple magazine substitution hypothesis, at least not with respect to the use of multiple guns. For example, in Koper et al.'s (2018) collection of mass firearm murders resulting in four or more deaths, cases in which shooters used multiple non-LCM guns averaged 5.3 fatalities and 7.2 total victims killed or wounded—averages substantially less than those for attacks with LCM firearms (regardless of number), especially for the total victim counts (see Table 2). Similarly, multiple gun cases without LCMs documented in the February 2019 version of the *Mother Jones* media organization's data on public firearm mass murders (4+ killed; Follman et al., 2019) resulted in substantially fewer victims killed and wounded than did cases with LCM firearms; averages killed were 7.2 for multiple non-LCM firearm cases and 10.0 for LCM cases (excluding the Las Vegas incident), whereas averages for the total killed and wounded were 11.4 for multiple gun non-LCM cases and 21.3 for LCM cases (excluding the Las Vegas incident).[17]

Others have also reported that victim differentials associated with the use of LCM firearms or semiautomatics more generally persist even when accounting for the use of multiple firearms (Blau, Gorry, & Wade, 2016; Jager et al., 2018; Klarevas, 2016). To illustrate, data reported by Klarevas (2016, pp. 221–224) show that "gun massacres" (defined as incidents with six or more fatalities) committed with multiple non-LCM firearms average 7.2 victims killed (calculated by the author from the Klarevas

figures), whereas LCM cases average 9.5 victims killed overall (see Table 2) and 11.2 victims killed when multiple guns are used that include an LCM firearm. As a final illustration, Kleck's compilation of shots fired estimates for a sample of 25 mass shootings that resulted in six or more victims killed or wounded from 1994 to 2013 shows that cases involving LCM firearms averaged at least 134 shots on average in comparison with ~26 shots on average for cases involving multiple non-LCM firearms (calculated from Kleck, 2016, p. 43).[18,19]

Notwithstanding these arguments, a more general caveat to this discussion is that the comparisons of mass shootings with and without LCM firearms reviewed above are bivariate and do not account for characteristics of the actors or situations that might influence attack outcomes and potentially confound the relationship between the types of weapons used and these outcomes. Such factors could include, among others, the intentions, motives, mental state, and skill of the shooter(s); the nature of the circumstances surrounding the shooting (e.g., offender and victim relationships); the type of location where the shooting occurred (e.g., whether it was indoors or outdoors, the type of venue, and how confined potential victims were); the number of people present who could have been shot deliberately or incidentally; the characteristics and health of potential victims; the number of shooters; and the numbers and types of weapons and magazines used. At present, such studies are lacking, but a few efforts have been made in this direction, such as the Jager et al. (2018) study referenced above. Similarly, in a regression analysis of 184 mass shootings, spree shootings, and active shooter incidents from 1982 through 2015, Blau et al. (2016) found that use of LCM firearms (but not AWs) increased fatality and total victim counts by 47% and 61%, respectively, controlling for several characteristics of the offenders and incidents. These covariates included the offender's mental health, age, and race, whether the incident occurred in a school or workplace, and the types of guns used by the offender.[20] Other studies suggest the need to also examine the interactions of elements like the shooter's mental health and the weaponry used in determining attack outcomes (Anisin, 2018).

Additional and more in-depth studies along these lines are needed to provide more precise estimates of the effects of high-capacity semiautomatics on the incidence and outcomes of mass shootings. It would also be helpful to have more detailed analyses of the dynamics of these events that reveal the number and timing of shots fired and persons hit (e.g., peak rates of fire and whether shots were fired in high-volume spurts or in continuous fashion), timing of reloads (if applicable), shots fired and persons hit with specific guns and magazines (if multiple guns or magazines were used), and victims killed or wounded with rounds fired in excess of ten when LCM firearms were used. Such information would likely have to be collected from police reports, forensic analyses, and court documents. Yet, despite the limitations of the currently available data and analyses, the differences in outcomes between LCM and non-LCM attacks are large enough to suggest that LCM restrictions could produce at least modest reductions in mass shooting fatalities and injuries over time.[21] In the next section, I turn to what is known about current and previous efforts to regulate LCM availability.

3 | EFFECTS OF ASSAULT WEAPON AND LARGE-CAPACITY MAGAZINE RESTRICTIONS ON MASS SHOOTINGS

During the last few decades, there have been several efforts to restrict the availability of AWs and LCMs at the national, state, and local levels. Below, I review research that has been conducted on federal and state restrictions, highlighting key features of these laws and what is known about their impacts on AW–LCM use and mass shootings. I also briefly address lessons that might be drawn from similar gun control measures implemented outside the United States.

3.1 | The federal assault weapons and large-capacity magazine ban of 1994

The federal AW–LCM law passed in 1994 imposed a ten-year ban on the "manufacture, transfer, and possession" of AWs and LCMs holding more than ten rounds of ammunition. The law's AW provision specifically prohibited 18 models and variations by name as well as revolving cylinder shotguns. It also contained a generic "features test" provision that generally prohibited other semiautomatic firearms having two or more military-style features. Other details of the law's provisions and coverage are reviewed elsewhere (Koper, 2004). A key feature needing emphasis here, however, is that the ban exempted all AWs and LCMs that were manufactured prior to the law's effective date of September 13, 1994. These guns and magazines were thus "grandfathered" and legal to own and transfer. Although imprecise, estimates suggest there were upward of 1.5 million privately owned in the United States when the ban took effect (Koper, 2004, p. 10). Moreover, gun owners in America possessed an estimated 25 million guns that were equipped with LCMs or ten round magazines in 1994 (Cook & Ludwig, 1996, p. 17), and gun industry sources estimated that, including aftermarket items for repairing and extending magazines, there were at least 25 million LCMs available in the country as of 1995. On top of this existing stock, an additional 4.8 million pre-ban LCMs were imported into the country from 1994 through 2000 under the grandfathering exemption, with the largest number arriving in 1999 (Koper, 2004, pp. 65–66). During this same period, importers were also authorized to import an additional 42 million pre-ban LCMs that may have arrived after 2000.

The short- and long-term effects of the federal AW–LCM ban on gun markets and gun violence more generally have been reported elsewhere (Koper, 2004, 2013; Koper & Roth, 2001, 2002; Roth & Koper, 1997, 1999; also see Gius, 2014). In short, the ban had mixed effects in reducing crimes with the banned weaponry as a result of its various exemptions and loopholes, particularly those pertaining to LCMs. Crimes with AWs began to decline shortly after the ban's passage, likely in part because of the interest of collectors and speculators in these weapons, which helped to drive their prices higher through the end of the 1990s (thus making them less accessible and affordable to criminal users). Criminal use of other semiautomatics equipped with LCMs, however, appeared to climb or remain steady through the late 1990s and into the early 2000s, adjusting for overall trends in gun crime (Koper, 2004, 2013).[22] Available evidence suggests that criminal LCM use eventually declined below pre-ban levels but only near the ban's expiration in 2004 (see especially Koper, 2013). As noted, crimes with LCM firearms have since increased. These trends are important to assessing the magnitude and timing of any impact that the federal ban may have had on the more specific problem of mass shootings.

Since the ban's expiration, several researchers studying mass shooting trends have examined variations in these incidents across the pre-ban, ban, and post-ban years. Fox and DeLateur (2014, pp. 324–327), for example, claimed that the federal ban had little impact on overall trends in firearm mass murder incidents (4+ killed) or victims based on Supplemental Homicides Report data from 1976 through 2011. Their data show that incidents and victims per month both increased by 4% to 5% during the ban years and then increased by larger amounts (14% and 21%, respectively) after the ban. Time series results suggested that both incidents and victims per month were lower during the ban years after accounting for general time trends, but neither the ban nor post-ban changes were statistically significant.

Similarly, Webster, McCourt, Crifasi, and Booty, in their state-level panel study (2020, this issue), suggested that the rate of mass murder incidents and victims did not change significantly during the ban years in comparison with their averages across the pre-ban (1984–1994) and post-ban (2005–2017) periods after controlling for state gun laws, time trends, state-level fixed effects, and various social factors. The results of their analyses, however, also show upward post-ban trends in the mass murder victim rate and the average number of victims killed per incident that accelerated dramatically

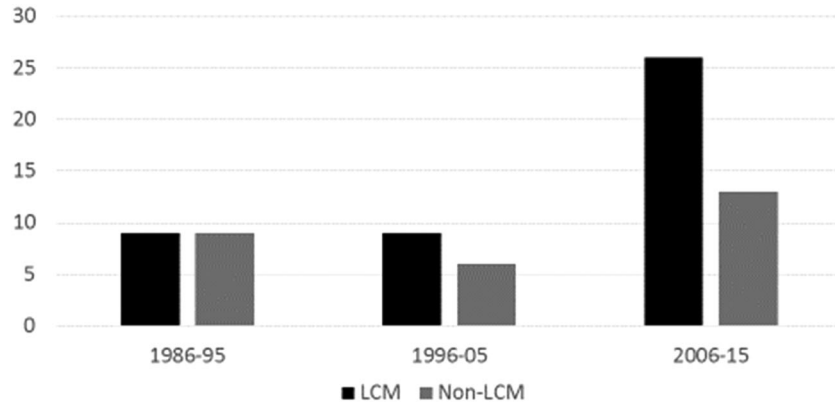

FIGURE 1 Gun massacres (6+ killed) by weapon type, 1986–2015
Source. Data taken from Klarevas (2016)

after 2014. Changes in offender motivations and behaviors seem to be driving this trend (Lankford & Silver, 2020), but the increasing availability of LCM weapons may also be a facilitator.

In contrast, others have argued that the federal ban reduced deaths and injuries from public mass shootings more specifically, citing reductions in both the occurrence of these events and the victims per incident average during this time (Blau et al., 2016; Cannon, 2018; DiMaggio et al., 2018; Gius, 2015; Lemieux, 2014; Phillips, 2017). Setting aside potential concerns about the completeness of these samples, the most sophisticated of these studies was conducted by Gius (2015), who examined the effects of the federal ban, as well as those of state AW–LCM bans, on deaths and injuries from public mass shootings (4+ killed) using a state-level panel analysis for the years of 1982–2011. Controlling for state-level demographics, population density, income, unemployment, prison population, and fixed effects for states and years, Gius's results suggest the federal ban reduced public mass shooting deaths and injuries by 66% and 82%, respectively. Gius, however, did not specifically examine the effects of the federal ban on mass shootings committed with AWs and other LCM semiautomatics.

A closer look at Gius's (2015) mass shooting data, which were taken from the *Mother Jones* collection of public shootings, yields a more nuanced picture. Compared with the pre-ban years, cases involving the use of an LCM firearm increased during the ban years, whereas the overall rate of cases held steady.[23] Both LCM and non-LCM cases then increased during the post-ban years. Hence, Gius's estimates seem to reflect a general post-ban increase in the rate and severity of public mass shootings as measured in the *Mother Jones* data and perhaps a drop in victims per incident during the ban years that was unrelated to changes in the use of LCM firearms.[24]

A comparable pattern also emerges from the work of Klarevas (2016), who found that "gun massacres" resulting in six or more fatalities declined in rate and severity (i.e., victim counts) during the federal ban (also see Klarevas, Conner, & Hemenway, 2019). This pattern is consistent with the notion that a reduction in AW and LCM use might have reduced the deadliest mass shootings. Klarevas stated that massacres specifically involving LCM firearms declined by one third during the ban (2016, p. 350) before rising substantially after its expiration. The overall incidence of these gun massacres, however, also declined by 37% during the ban years (2016, p. 242), which suggests the decline in LCM cases was proportional to a more general reduction in non-LCM cases and likely independent of the federal ban. A similar pattern can be seen in more detailed figures that Klarevas reported for the periods of 1986–1995, 1996–2005, and 2006–2015, which roughly approximate the decades before, during, and after the federal ban (2016, p. 219). As shown in Figure 1, massacres involving LCM firearms were

stable from the first to the second period (9 for each period, although AW cases declined) and then nearly tripled during the third period. Cases not involving LCMs declined by one third from the first to the second period and then more than doubled during the next decade.[25]

Overall, therefore, it seems that mass shootings with LCM firearms remained steady during the ban years, relative to pre-ban levels, or declined in proportion to trends in mass shootings more generally. Reductions observed during the ban years for some categories of mass shootings seem more likely to have been attributable to other factors, a conclusion that is consistent with other research on the wider effects of the federal ban. The law's significant exemptions ensured that its full effects would occur only gradually over time, and those effects were still unfolding at the time it expired (Koper, 2004, 2013). Nonetheless, these mass shooting studies have also underscored the federal ban's preventive value in capping and eventually reducing the supply of AWs and LCMs. What is arguably most notable in the preceding studies is the rise in mass shootings with LCM weapons that has occurred since the end of the federal ban and its correspondence with increasingly lethal and injurious incidents. This rise in LCM use would arguably have not happened, or at least not to the same degree, had Congress extended the ban in 2004. Considering that mass shootings with high-capacity semiautomatics are considerably more lethal and injurious than other mass shootings, it is reasonable to argue that the federal ban could have prevented some of the recent increase in persons killed and injured in mass shootings had it remained in place.[26] This is a more subtle and nuanced policy argument, but one that is central to understanding the value of the previous federal ban and any reconstituted version of that law that may be considered or implemented in the future.

3.2 | State bans on assault weapons and large-capacity magazines

In addition to the expired federal ban, several states have also made efforts to restrict AWs and/or LCMs. Currently, nine states have LCM bans, and all but two of these states have AW restrictions that were passed contemporaneously with or before the LCM restrictions. Table 3 provides an overview of these laws with primary emphasis on their LCM provisions. As shown, there are important differences between these state laws, and there have been significant changes in specific state laws over time. For example, some states began with only AW restrictions and later expanded their laws to cover LCMs. The LCM provisions also differ and have changed over time with respect to magazine capacity limits and whether pre-law LCMs are grandfathered (and whether grandfathered LCMs require registration). The latter issue may be particularly consequential as LCM owners in states without grandfathering provisions must discard or relinquish their LCMs, potentially making those laws more effective and their impacts more rapid.[27] Also note that some important changes to LCM laws have only recently taken effect.

State-level AW and LCM restrictions have potential strengths and weaknesses relative to the prior federal ban. A weakness is that the impacts of state regulations can be offset to some degree by the inflow of prohibited weaponry from nonrestrictive states.[28] On the other hand, some state AW–LCM laws could potentially have larger and more rapid effects than did the federal ban depending on their specifics with regard to whether they allow continued possession and/or transfer of pre-law AWs and LCMs. To my knowledge, there has been little-to-no study of the implementation of these state laws (including aspects of enforcement and punishment) or their impacts on the availability and criminal use of LCM firearms.[29] A few studies, however, have examined the association of state-level AW–LCM laws with gun violence and other crimes. In those studies that have examined gun homicides and other shootings (the crimes that are logically most likely to be affected by LCM bans), evidence has been mixed. Although states with AW and LCM laws tend to have lower gun murder rates, this association is not statistically significant when controlling for other social and policy factors

TABLE 3 State restrictions on large-capacity magazines

State and Year of Initial Implementation	Magazine Capacity Limit	Grandfathering of Pre-Law LCMs	Assault Weapon Restrictions
California (2000)	10	Yes	Yes (1989)
Colorado (2013)	15	Yes	No
Connecticut (2013)	10	Yes (with registration)	Yes (1993)
Hawaii (1992)	10 (handgun magazines)	No	Yes (1992)
Maryland (1994)	20 (1994), 10 (2013)	Yes	Yes (1994)
Massachusetts (1998)	10	Yes	Yes (1998)
New Jersey (1990)	15 (1990), 10 (2018)	No (some exceptions for 11–15 rounds with registration)	Yes (1990)
New York (2000)	10	No (2013)	Yes (2000)
Vermont (2018)	10 (long guns), 15 (handguns)	Yes	No

Notes. The dates for assault weapons restrictions represent the first year when any such restriction was implemented. Note that Washington, D.C., has also had LCM restrictions since 2009.

Sources. Law Center to Prevent Gun Violence (https://lawcenter.giffords.org/), Vernick and Hepburn (2003), and Klarevas et al. (2019).

(Fleegler, Lee, Monuteaux, Hemenway, & Mannix, 2013; Gius, 2014; Koper & Roth, 2001; also see Moody & Marvell, 2018). Nonetheless, it is difficult to draw definitive conclusions from these studies given the lack of evidence on the implementation and market effects of these laws and the fact that studies have not accounted for important differences in the laws across states and over time—most critically, where and when they included LCM bans and grandfathering provisions.

A growing number of studies have also examined the effects of state LCM laws on mass shootings more specifically. Most notably, Webster et al. (2020), in their state-level panel analysis of mass murders from 1984 through 2017, suggested that state LCM bans reduce mass murder incidents (4+ killed) and fatalities whereas AW-specific restrictions do not. Controlling for several types of gun laws, gun availability, socioeconomic variables, time trends, and other state-level differences, Webster et al. estimated that states with LCM restrictions had ~50% fewer mass murder incidents during their study period.[30] Effects on fatal victim counts appeared greater but more variable in statistical significance, and the laws seem to have had their clearest effects on mass murders involving a domestic relationship between the perpetrator and one or more of the victims. LCM laws also appeared to reduce more deadly mass shootings (those with more than four or five fatal victims) in some model specifications.

Along similar lines, Klarevas et al. (2019) studied the effects of LCM-specific restrictions on mass shootings resulting in six or more deaths from 1990 through 2017, distinguishing between incidents committed with and without LCM firearms. Controlling for the years of the federal ban, time trends, and state-level differences in gun availability and other social factors, they found that mass murders committed with LCM firearms were significantly less likely and produced significantly fewer total fatalities in LCM ban states. States with LCM laws also had substantially lower levels of firearm mass murders overall (for example, total deaths from these incidents were 95% lower in

LCM ban states after controlling for other covariates), although these differences were not statistically significant.

The Webster et al. (2020) and Klarevas et al. (2019) studies provide the strongest evidence to date for the efficacy of state LCM bans in reducing mass shootings. Both studies are particularly noteworthy for distinguishing between state AW and LCM restrictions. Taking the results of these studies at face value, nonetheless, it remains unclear whether effects from LCM laws vary based on differences in their provisions (such as whether they grandfather pre-law LCMs), the strength of their implementation, or how long they have been in effect.

Other aspects of the studies also leave ambiguities. The Webster et al. (2020) analysis, for instance, does not establish a direct link between LCM laws and use of LCM firearms in mass murders. Furthermore, the fact that LCM laws appear more consistently linked to domestic-related mass murders in their analysis is somewhat surprising (and perhaps indicative of some misspecification in their models) considering that LCM weapons are used more frequently in public mass shootings and seem to have their greatest potential for enhancing the lethality of public incidents (see earlier discussion and Table 2).[31] The Klarevas et al. (2019) study makes a more direct connection between LCM restrictions and lower use of LCM firearms for a smaller subset of more severe mass murders. The rarity of these particular events (there were 69 across the 28-year period studied by Klarevas et al.), however, makes it difficult to determine conclusively whether LCM laws reduce their overall occurrence and death tolls.[32] The effects of LCM laws on mass murder deaths may also be overestimated in these studies as they seem much larger than would be expected based on the extrapolations from incident-level analyses discussed previously (see Table 2). Finally, neither study examined the effects of LCM bans on nonfatal gunshot injuries from mass shootings.

Other state-level studies have yielded mixed evidence on how state AW–LCM laws affect mass shootings. Luca, Malhotra, and Poliquin (2019) reported that these laws are unrelated to the incidence of nondomestic mass murders, which they approximated using incidents in which at least three fatal victims were unrelated to and not romantically involved with the shooter. In contrast, the Gius (2015) study of public mass shootings (referenced above) suggests that state AW–LCM laws reduce deaths from public mass shootings by 45% while having no effect on mass shooting injuries. In a similar vein, Blau et al. (2016) found that public shooting incidents of various sorts (see Footnote 20) are lower in states with AW–LCM bans, even though it is not clear from their analysis whether this is true for public mass shootings specifically (hence, the results could reflect differences across states in the propensity of people to engage in public shootings). They also did not find evidence of AW—LCM laws reducing the use of AWs in these incidents.

Inferences from these additional studies, however, are unclear as a result of multiple problems. Besides lacking specific measurement of LCM firearm use, these studies fail to differentiate between AW and LCM laws, lumping them together into one category. Consequently, the studies do not account for which of these states had LCM restrictions and when.[33] Other idiosyncrasies in the samples, measures, methods, and findings also complicate interpretations.[34,35]

To provide some additional but tentative insight into this issue, Table 4 examines the occurrence of mass shootings with LCM weapons in states with and without LCM restrictions in the years since the expiration of the federal ban. The tabulations are based on the Koper et al. (2018) sample of firearm mass murders with four or more killed from 2009 to 2015, the *Mother Jones* data (as of February 2019) on public mass murders with four or more killed from 2005 to January 2019, and the Klarevas et al. (2019) data on firearm mass murders with six or more killed from 2005 through 2017. Each incident in these sources was coded according to whether it occurred in a state and year in which any type of LCM restriction was in effect, regardless of grandfathering, magazine capacity limit, or AW provisions. Table 4 shows the percentages of firearm mass murder cases that involved an LCM firearm,

TABLE 4 Use of high-capacity semiautomatics in firearm mass murders in states with and without restrictions on large-capacity magazines

Data Source and Sample	State-Years with LCM Bans: Total Cases and % With LCMs (min. estimates)	State-Years Without LCM Bans: Total Cases and % With LCMs (min. estimates)
Koper et al. (2018): all firearm mass murders with 4+ killed, 2009–2015 ($N = 145$)	$n = 22$ incidents 18% – 27% involving LCM	$n = 123$ incidents 12% – 17% involving LCM
Mother Jones (Follman et al., 2019): public firearm mass murders with 4+ killed that did not involve other crimes, 2005–Jan. 2019 ($N = 56$)	$n = 14$ incidents 36% – 50% involving LCM	$n = 42$ incidents 50% – 64% involving LCM
Klarevas et al. (2019): all firearm mass murders with 6+ killed, 2005–2017 ($N = 47$)	$n = 8$ incidents 50% involving LCM	$n = 39$ incidents 72% involving LCM

Notes. Minimum estimated ranges of LCM use from Koper et al. (2018) and *Mother Jones* (Follman et al., 2019) sources are based on cases in which LCMs were explicitly reported (lower bound) or in which gun models were identified that are sold with LCMs (upper bound).

contrasted for LCM ban state-years and state-years without LCM restrictions. The figures from Koper et al. and *Mother Jones* are minimum estimated ranges of LCM use based on cases in which LCMs were explicitly reported (lower bound) or gun models were identified that are sold with LCMs (upper bound). No further adjustments were made for missing gun data. The Klarevas et al. numbers are based on cases in which LCM use was clearly identified by the authors. Irrespective of differences in the level of mass shootings across states (which could be affected by numerous factors), these figures provide some indication as to whether mass shootings in LCM ban states are less likely to involve firearms equipped with LCMs when they do occur.

With the caveat that the samples are small, the estimates reveal an inconsistent pattern. In the Koper et al. (2018) and *Mother Jones* samples, the estimated range of cases involving an LCM overlaps between the states with and without LCM restrictions. Using the broadest sample of firearm mass murders (Koper et al.), the estimated range for LCM cases seems somewhat higher in the LCM restriction states. In contrast, LCM use appears lower in the LCM ban states when focusing on public mass shootings (*Mother Jones*) or mass shootings with the highest fatality counts (Klarevas et al., 2019).[36] Hence, inferences about the effectiveness of LCM restrictions could be conditional on the types of incidents under examination.

In summary, growing evidence suggests LCM restrictions reduce mass shootings and are more potent than AW-only restrictions. Nonetheless, the evidence is not yet sufficient to draw definitive conclusions. Further research is needed on the implementation and outcomes of these laws more generally, with particular attention to how variations in their provisions and implementation affect the magnitude and timing of their impacts on criminal LCM use and gun violence. Another important consideration may be how AW-LCM laws are used in tandem with other state gun laws (e.g., gun registration laws) that could enhance their effectiveness. Such studies could inform state-level policymaking by illuminating the types of AW and LCM regulations that are most optimal for reducing deaths and injuries from the use of high-capacity semiautomatics.

3.3 | Similar weapon bans outside the United States

Outside the United States, a few other nations have also passed regulations on semiautomatic weapons and/or LCMs (Masters, 2017). Scholarly inquiry on these laws has focused primarily on Australia's semiautomatic rifle ban and buyback program that was implemented after a highly tragic and infamous mass shooting in that nation in 1996 (the Port Arthur massacre). As shown by Chapman, Alpers, and Jones (2016), Australia had 13 mass shootings (defined in their study as incidents resulting in five or more deaths) in the 18 years prior to that law and zero for at least 19 years after its passage (notwithstanding more recent incidents). This provides provocative evidence that tight restrictions on AW-type and other high-capacity semiautomatics can prevent mass shootings. Setting aside the political and practical feasibility of implementing AW and/or LCM bans with buybacks in the United States, however, conclusions about the impacts of the semiautomatic rifle ban in Australia—and its applicability to the United States—should be qualified by a few considerations. The 1996 Australian gun reforms included several additional provisions relevant to firearms licensing, registration, training, storage, and sales (Peters, 2013), all of which may have conceivably contributed to the reduction in mass shootings. Furthermore, some evidence suggests that other social factors reducing violence more generally may have also played a role in reducing mass shootings and gun violence in Australia in the years since the gun reforms (Chapman et al., 2016). The fact that Australia had strict regulation of handguns even before 1996 (Peters, 2013) also suggests that regulations focused on semiautomatic rifles, while potentially efficacious, would not likely have the same level of impact on gun violence and mass shootings in the United States.

4 | DISCUSSION AND CONCLUSION

In conclusion, despite numerous challenges to studying the issues addressed herein, this article highlights a few key points about the use, impacts, and regulation of high-capacity semiautomatic weapons as they pertain to the problem of mass shootings in the United States. LCM firearms are used in between 20% and 58% of all firearm mass murders, and they are used in a particularly high share of public mass shootings. Mass shootings perpetrated with LCM firearms result in substantially more fatalities and injuries than do attacks with other firearms, and these differences are particularly pronounced for nonfatal gunshot injuries. Quantifying the unique contribution of LCM firearms to these outcomes with greater precision, independently of or in interaction with offender and situational characteristics, will require further and more sophisticated study. Notwithstanding, extrapolations from available data imply that tighter regulation of high-capacity firearms could potentially reduce mass shooting fatalities by 11% to 15% and total fatal and nonfatal injuries from these attacks by one quarter, with larger impacts for public mass shootings. For reasons discussed, actual impacts from LCM regulation seem likely to be lower, although some aggregate-level studies raise the possibility of larger effects. Nonetheless, these figures are high enough to suggest that tighter regulation of high-capacity semiautomatic weaponry—and restriction of LCMs in particular—is one policy measure that can contribute meaningfully to reducing deaths and injuries from mass shootings. Effects may be modest and gradual, however, depending on the form of those regulations.

The federal AW–LCM ban of 1994 had important exemptions and loopholes that limited its impacts in the short run. Its expiration in 2004, however, was followed by an upswing in mass shootings with high-capacity semiautomatics that has contributed to more severe incidents with higher fatalities and injuries. Policy makers who wish to reinstate a new version of the federal ban should give careful consideration to any grandfathering provisions in future legislation. Assessing the political and practical

difficulties of registering all AWs and LCMs or establishing turn-in or buyback programs for them is beyond the scope of this article.[37] Policy makers should note, however, that it may take many years to attain substantial reductions in crimes committed with banned guns and/or magazines if a new law exempts the existing stock, which has likely grown considerably since the time of the original ban. Policies regarding exemptions must also explicitly address the status of imported guns and magazines.

In the meantime, further research is needed on the implementation and effects of state restrictions on AWs and LCMs (and perhaps those at the local level as well). Although some studies indicate that mass shootings are lower in states with these laws (and LCM bans in particular), more evidence is needed to show definitively that these laws reduce crimes with LCM firearms and, in turn, reduce mass shootings and other gunshot victimizations. Further research is also needed to determine whether the effectiveness of these laws varies based on their specific provisions.

The conclusions offered here are also subject to various caveats regarding the current state of data and research on mass shootings. Better data collection systems are needed to track mass shootings and document the features of these incidents, including the type of weaponry used.[38] There is also a need for more studies that analyze the dynamics and outcomes of attacks with different types of guns and magazines. Such studies would help to refine our understanding of how changes in the use of high-capacity semiautomatics affect the incidence and severity of mass shootings. This essay has also focused on firearm mass murders resulting in four or more deaths. As data become more widely available for tracking multiple victim shootings, studies using different definitions of mass shootings (e.g., based on total injury counts) could provide a wider perspective on how the use and regulation of LCM firearms affect mass violence. Finally, future studies will also need to further assess whether firearm restrictions, including those on AWs and LCMs, lead to substitution of other methods in attempts to inflict mass casualty events (and with what results).

In closing, restrictions on AWs and LCMs are not a complete solution for the problem of mass shootings or public mass shootings more specifically. Nonetheless, they are modest policy measures that can likely help to reduce the incidence and severity of mass shootings over time. Given the high social costs of murders and shootings,[39] these laws could produce substantial savings for society even if their effects on mass shootings are modest.

ENDNOTES

[1] A semiautomatic weapon fires one bullet for each squeeze of the trigger. After each shot, the gun automatically loads the next round and cocks itself for the next shot, thereby permitting a faster rate of fire relative to nonautomatic firearms. Semiautomatics differ from fully automatic weapons (i.e., machine guns), which fire continuously as long as the trigger is held down. Fully automatic weapons have been illegal to own in the United States without a federal permit since 1934.

[2] The federal government's 1994 AW ban defined AWs based on having two or more of such features, as do some current state laws. In contrast, several current state laws and a new federal ban proposed (unsuccessfully) in 2013 define AWs based on a one-feature criterion.

[3] Gun manufacturers report data on total handgun, rifle, and shotgun production to federal authorities, with handgun figures further differentiated by caliber. They are not, however, required to report any further detail on production by model, firing mechanism (semiautomatic vs. other), or magazine capacity.

[4] Estimates of their use tend to be higher for different types of shootings, including mass shootings (discussed below) and gun murders of police.

[5] Consistent with other research and reporting, this definition is also generally limited to cases in which the victims were killed in the course of one event that occurred in one or more locations in close proximity.

[6] Researchers commonly use the FBI's Supplemental Homicide Reports (SHR) to identify homicide incidents with multiple fatalities in the United States, although some have noted substantial numbers of mass murders that do not

appear in the SHR. Furthermore, the SHR does not provide counts of additional wounded victims, nor does it provide detail on firearms used beyond basic handgun, rifle, and shotgun designations.

[7] In a study of firearm mass murders from 1999 to 2013, the Congressional Research Service reported that public mass shootings produced 49% to 58% more fatalities and 8 to 17 times as many wounded victims per incident than did family and other felony-related cases (Krouse & Richardson, 2015).

[8] For example, a firearm identified simply as a "semiautomatic handgun" or as a "semiautomatic rifle" might or might not be an LCM firearm or an AW depending on the particular model. Even when models are identified, there may be ambiguity about LCM use in the absence of specific magazine information. Some firearm models can be sold with LCMs or smaller magazines, whereas some firearms not sold with LCMs at retail can be equipped with aftermarket LCMs.

[9] In some cases involving reported AW use, the firearm may only be identified generically in public accounts as an "assault rifle" or as an "assault weapon."

[10] Additional sources on public mass shootings have also yielded figures similar to those in Table 2. Cannon (2018) reported that AWs and other high-capacity semiautomatics were used in 65% of 79 public firearm mass murders documented by the Citizens Crime Commission of New York City from June 1984 through February 2018. This database mainly overlaps with the *Mother Jones* collection, although with some notable differences. Similarly, Lemieux (2014) found that AWs were used in 26% of 73 public mass murder incidents he studied from 1983 to 2013, and Capellan and Gomez (2018) estimated that "rifles or assault rifles" were used in approximately 23% of 206 mass murders or attempted mass murders they documented from 2000 to 2015. Both of these AW estimates are similar to that of Krouse and Richardson (2015).

[11] In other words, forcing the substitution of low-capacity weapons in these cases would likely reduce the number of victims killed in some cases, thereby reducing the number of incidents that would qualify as a mass murder.

[12] The FBI's active shooter data does not include details about the types of weapons used other than basic handgun, rifle, and shotgun designations. To identify cases involving semiautomatic rifles, Jager et al. (2018) supplemented the FBI data with information from court and police records as well as from news sources.

[13] For older studies showing higher victim counts for mass shootings with LCM firearms or AWs more specifically, see Duwe (2007) and Koper (2004). On a related note, Anisin (2018) reported that mass shooting incidents (3+ shot) are more likely to result in mass murders (4+ killed) when offenders use AWs or multiple firearms, although it is not possible to determine the unique effect of AWs from the analysis.

[14] Note that Table 2 includes two sources on mass public shootings that mainly overlap but not completely. I have used the study of the Citizens Crime Commission of New York City (CCCNYC; Cannon, 2018) as a complement to studies of the well-known *Mother Jones* news organization's database (Follman et al., 2019) because the CCCNYC appears to have made definitive determinations as to the use of AWs and LCM firearms for the 79 cases reported. (The cases that CCCNYC has identified as AW–LCM cases are currently listed on the organization's website for the years 1984–2012 but not for more recent years.) I have taken these designations at face value for the purposes of this review. In contrast, Dillon's (2013) analysis of the *Mother Jones* data for 1982–2012 compared 31 cases that clearly involved LCM weapons with 31 cases that either did not involve LCM use or (much more commonly) did not provide sufficient information for a clear determination about LCM use. More generally, examining public mass shootings as reported in multiple data sources to search for common patterns helps to compensate for some of the differences in event coverage and details across these sources. On a related note, Lemieux (2014) reported that use of AW-type rifles was not associated with victim counts in his examination of 73 public mass murder incidents from 1983 to 2013. He did not report specific figures and did not address use of other LCM firearms, however.

[15] As one illustration, the Koper et al. (2018) database includes 27 cases that involved LCM firearms. Assuming these were the only LCM cases—or the only ones in which LCM use substantially affected the outcomes—we can estimate the number of deaths and injuries that could have potentially been prevented if the attackers had used non-LCM firearms. Focusing on total victims, there were 978 people killed or wounded across the sample. The LCM cases produced 13.67 killed and wounded victims on average, accounting for a total of 369 of these victims. If the LCM attacks had been conducted with non-LCM firearms, we can estimate that they may have only resulted in 5.16 victims on average (based on the observed average for non-LCM/unknown cases) producing a total of 139 victims. This would have reduced gunshot victims by 230 (i.e., 369–139), amounting to an overall reduction of 24% across the full sample ($230/978 \times 100$).

[16] In the Everytown (2018) sample, the potential reduction in deaths rises to 19% if the Las Vegas shooting is included and the potential reduction in total victims rises to 45%.

[17] The calculations for both databases count multiple gun non-LCM cases as those in which the firearms used were clearly not LCM firearms or were not known to be such. The LCM firearm cases include instances of both single and multiple gun use in which offenders clearly used an LCM(s) or LCM compatible firearm(s). Note that some multiple gun cases also involve multiple shooters, although these are rare.

[18] The non-LCM multiple gun cases involved two to four firearms, whereas the LCM cases ranged from one to four. Even after excluding LCM cases with more than two firearms, the average number of shots fired for LCM cases (54) was roughly double that in the non-LCM multiple gun cases.

[19] More extended discussion of some of the issues surrounding the use of multiple guns and/or magazines in mass shootings are provided by Kleck (2016) and Klarevas (2016). Kleck (2016) argued that LCM restrictions would have no appreciable impact on the outcomes of mass shootings because shooters with multiple non-LCM firearms or magazines can quickly and easily switch guns or change magazines, particularly during the course of attacks that take place over the course of several minutes or longer periods. The counter argument, noted above, is that firearm and magazine changes create pauses in shooting that give potential victims and bystanders additional seconds to escape, take cover, or possibly overtake and incapacitate the shooter. Besides the data presented above in reference to cases with multiple guns, some have also offered more detailed arguments surrounding the use of multiple non-LCM magazines. Drawing on tests and reports from shooting experts, for example, Klarevas (2016, pp. 211–212) estimated that using a semiautomatic with a 30-round LCM doubles an average shooter's firing rate and shooting time per minute relative to using a semiautomatic with multiple 10-round magazines (LCM effects are much greater when compared with using a 6-shot revolver). In this scenario, a shooter trying to fire continuously with 10-round magazines would have to spend 40 seconds reloading every minute in contrast to only 20 seconds for a shooter with 30-round magazines. We can expect that these differences would be less pronounced for offenders using smaller LCMs (e.g., in the 11–20-round range), but these estimates also assume that attackers have the time, skill, and poise to reload without problems (like fumbling for or dropping a gun or magazine). Besides giving shooters the ability to wound more people more rapidly, Klarevas also emphasized that LCM use makes them more invulnerable to counterattack as people at the scene must flee or take cover when faced with a sustained barrage of gunfire. This perhaps explains why mass shooters with LCMs have had time to make magazine changes when needed in several prominently reported cases and have only rarely been subdued by bystanders (facts highlighted by Kleck). A more insightful analysis in this regard might be to examine these issues in the context of mass shootings and near mass shootings perpetrated by offenders with non-LCM firearms and magazines (e.g., looking at issues such as the number of shots they fired, the number of gun/magazine changes they made, how often they were subdued by bystanders, and the like). Finally, this debate also highlights the need for more in-depth studies of the dynamics of mass shootings that take into account how gunfire unfolds over the course of these incidents. Kleck noted that mass shootings often occur over many minutes and argued that the average rates of gunfire in LCM cases could readily be achieved with non-LCM weapons. The average rate of gunfire as calculated from the total length of an incident, however, will not always be indicative of how the event unfolded or the peak rate of gunfire that occurred. Some events involve spurts of gunfire followed by pauses as offenders move through a location, search for additional victims, and/or reload (e.g., see the detailed descriptions of selected cases provided by Klarevas). As one example, the Virginia Tech massacre perpetrated by Seung-Hui Cho in April 2007 involved approximately 174 shots that were fired over the course of 156 minutes (Kleck, 2016, pp. 34, 43). This suggests an average firing rate of one round every 54 seconds, which is a misleading characterization of how the gunfire occurred (e.g., see Klarevas, 2016, pp. 94–95). Analyzing the details and dynamics of mass shootings in more systematic depth (e.g., numbers of shots fired continuously or in spurts and with what guns and magazines) would be useful in more precisely understanding how LCM firearms affect the outcomes of these events.

[20] The Blau et al. (2016) findings should be interpreted cautiously given certain aspects of the data. Drawing from a few public sources, the sample appears to have consisted of public mass shootings resulting in four or more deaths from 1982 to 2015, public spree shootings resulting in two or more fatalities from 1982 to 2015, and active shooter incidents as identified by the FBI, which have no victim count criteria, from 2000 to 2013. This mixing of data sources introduces inconsistent measurement across the timeframe of the study. In addition, identification of LCM firearms and AWs is not discussed in any detail, which is potentially problematic, especially considering that the FBI active shooter data do not identify firearm models or even which guns were semiautomatics.

[21] This conclusion is also supported indirectly by the wider body of research that has attempted to determine the impacts of weaponry on the outcomes of violent events (i.e., weapon "instrumentality") while controlling in different ways (albeit, imperfectly) for characteristics of the situations and actors involved. Most of this research has focused on the effects of guns relative to the use of other or no weapons (e.g., Alba & Messner, 1995; Felson & Messner, 1996; Wells & Horney, 2002; Zimring, 1968), although a few studies (besides those noted in text) have used such methods to contrast attacks involving different types of firearms (Libby & Corzine, 2007; Libby & Wright, 2009; Zimring, 1972). Collectively, these studies affirm the notion that attacks with more lethal weapons are more likely to result in deaths and serious injuries. Hence, even if more lethally minded offenders choose more dangerous weaponry, the evidence suggests overall that the chosen weaponry has an independent effect in facilitating the realization of the offender's intentions.

[22] Trends in criminal use of AWs and LCMs were measured using several national and local data sources on guns recovered by police, with a focus on changes in AWs and LCM weapons as a share of gun recoveries. Assessing trends in LCM use was more difficult because there is no national data source on crimes with LCMs, and local police agencies do not typically record magazine capacity in their gun recovery databases. It was possible, nonetheless, to examine LCM use in a small number of geographically diverse jurisdictions, which revealed some common trends.

[23] There were at least seven LCM incidents from 1982 through 1994 and at least eight from 1995 through 2004 (including other cases that likely involved LCMs would magnify this increase). Conclusions about these trends are contingent on the completeness and reliability of the data over time, which some researchers have criticized (e.g., see Duwe, 2020). The point here, nonetheless, is to illuminate the patterns in these data as analyzed by Gius (2015).

[24] Similar patterns can be discerned from the CCCNYC's listing of public mass shootings with 4+ killed (Cannon, 2018). Their collection shows 10 AW–LCM incidents in the decade before the ban and 11 during the decade of the ban (cases without AWs or LCMs declined during this time). After the ban (September 2004–February 2018), both LCM and non-LCM cases increased in rate and victim counts (the latter increase was most pronounced for LCM cases). Finally, Blau et al. (2016) also reported that public shootings of various sorts (see Footnote 20) were lower during the federal ban, but they did not find lower levels of AW use in these incidents.

[25] Interestingly, deaths per incident in LCM cases also declined during the ban in Klarevas's (2016, p. 350) data (from 9.1 before the ban, to 7.7 during the ban, to 9.2 after), a pattern that is also apparent in the CCCNYC report on public mass murders with LCM firearms (see Cannon, 2018). These changes also seem more likely to reflect a general secular trend than an effect from the federal law, unless perhaps they were caused by a decline in the use of specific LCM models, like AWs, that have particularly large magazines. Klarevas reported a decline in AW cases during this time, but there is not sufficient detail presented in either source to examine this carefully.

[26] For further discussion of the ban's potential to reduce shootings more generally, see Koper (2013) and Koper et al. (2019).

[27] The constitutionality of this requirement is currently being litigated in a federal court challenge to a new California law that would end the state's prior LCM grandfathering exemption. This type of restriction, however, has been upheld in prior federal court cases involving other state and local LCM laws.

[28] States with more restrictive gun laws, however, have lower levels of gun availability and gun homicide in general (e.g., Fleegler, Lee, Monuteaux, Hemenway, & Mannix, 2013; Miller, Azrael, & Hemenway, 2002; Siegel, Ross, & King, 2013). Some studies also suggest that state-level restrictions can be effective in reducing crimes with particular categories of firearms (Vernick, Webster, & Hepburn, 1999; also see Loftin, McDowall, Wiersema, & Cottey, 1991).

[29] A few fragmentary accounts include a media report that crimes with LCM firearms continued rising in Baltimore for at least the first few years after Maryland's reduction of its LCM capacity limit from 20 to 10 rounds in 2013 (Freskos, 2017). In contrast, a study of guns recovered by police in multiple jurisdictions around the country found some indications that LCM firearms are less common in jurisdictions with LCM laws (Koper et al., 2018).

[30] This discussion is based on a pre-publication draft of the Webster et al. (2020) study.

[31] It is not clear from their data, however, how often the domestic and nondomestic incidents occurred in public or the types of venues in which they occurred.

[32] The Klarevas et al. (2019) results may have also been affected by the omission of other gun laws that might affect mass shootings (see Webster et al., 2020; also see Reeping et al., 2019).

[33] On a related note, it is not clear whether Luca et al. (2019) and Blau et al. (2016) included Colorado as a ban state after it enacted LCM-only restrictions in 2013.

[34] Besides issues noted in text, Luca et al. (2019) may not have used an appropriate functional form for their cited models (see discussion in Webster et al., 2020). Gius's (2015) finding that AW–LCM laws reduce mass shooting deaths but not injuries is at odds with data showing that LCM use is more strongly associated with injuries when examining incident-level outcomes (see Table 2). In addition, with the exception of concealed carry laws, Gius did not account for other state gun laws that appear related to the level of mass shootings more generally (Reeping et al., 2019; Towers, Gomez-Lievano, Khan, Mubayi, & Castillo-Chavez, 2015; Webster et al., 2020; but also see Lin, Fei, Barzman, & Hossain, 2018 with regard to public shootings). See Footnote 20 for additional caveats regarding Blau et al. (2016). Finally, these studies did not include measures of overall gun availability, which has been linked to mass shootings in some studies (Reaping et al., 2019; Towers et al., 2015; but see Klarevas et al., 2019; Webster et al., 2020) and is generally lower in LCM ban states (which tend to have higher numbers of other gun restrictions as well).

[35] A CNN news story (Petula, 2017) referenced another analysis reportedly showing that state LCM regulations reduce mass shootings, but this study has not been published or publicly disseminated to my knowledge.

[36] Given the limits of these data, I have not undertaken extensive comparisons across LCM ban states or examined changes over time. One notable aspect of the data, however, is that most of the mass murders in the LCM ban states (and many of the cases involving LCM use) occurred in California. Accordingly, future studies of state LCM bans might give careful consideration to how patterns in California compare with those of other LCM ban states. It is also noteworthy that there were no confirmed LCM cases in these sources in states that had LCM restrictions with conditional or no grandfathering of pre-ban LCMs. There was one case that involved an LCM-compatible firearm (with no further information on the magazine type) in Washington, DC, shortly after the city passed its own LCM ban without grandfathering.

[37] See Klarevas (2016, pp. 257–258) for a discussion of implementation and cost considerations surrounding a national LCM ban and turn-in program.

[38] More generally, there is a need for better data on crimes with guns having LCMs. Policymakers should thus encourage police agencies to record information about magazines recovered with crime guns. Likewise, ATF should consider integrating ammunition magazine data into its national gun tracing system and encourage reporting of magazine data by police agencies that trace firearms.

[39] Cost of crime estimates suggest the full societal costs of each homicide in the United States (including medical, criminal justice, and other government and private costs, both tangible and intangible) may be as high as $5 billion to $11.6 billion as measured in 2007 dollars (Heaton, 2010). The full social costs of gunshot victimizations were estimated to be as high as $1 million in 2000 (Cook & Ludwig, 2000). Also see Webster (2017) for further discussion of the consequences and costs associated with mass shootings in particular.

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How to cite this article: Koper CS. Assessing the potential to reduce deaths and injuries from mass shootings through restrictions on assault weapons and other high-capacity semiautomatic firearms. *Criminol Public Policy*. 2020;19:147–170. https://doi.org/10.1111/1745-9133.12485